

CLAIMS

What is claimed is:

1. A particle accelerator system for producing a charged particle beam having pulses of
5 charged particles that have different energy levels from pulse to pulse, said particle
accelerator comprising:
 - a power source for generating electromagnetic waves;
 - an injector for producing pulses of charged particles;
 - a first accelerating section operable to receive said pulses of charged particles
10 from said injector, said first accelerating section being further operable to receive said
electromagnetic waves and to transfer energy thereof to said pulses of charged particles;
 - a second accelerating section operable to receive said pulses of charged
particles from said first accelerating section and to transfer energy to said pulses of charged
particles; and,
 - 15 a phase shifter interposed between said power source and said second
accelerating section for receiving said electromagnetic waves, for alternatively changing the
phase of said electromagnetic waves between successive pulses of said pulses of charged
particles, and for delivering said electromagnetic waves to said second accelerating section.
- 20 2. The particle accelerator system of Claim 1, wherein said phase shifter comprises a
high-speed phase shifter having a rotary reflector therein.
3. The particle accelerator system of Claim 1, wherein said phase shifter comprises a
high-speed phase shifter having a waveguide shorting device and a waveguide discharger,
25 wherein said waveguide shorting device is connected at the end of said waveguide discharger.
4. The particle accelerator system of Claim 1, wherein said phase shifter comprises a
high-speed phase shifter having a waveguide segment, wherein said waveguide segment has
an outer wall, a ferrite element positioned within said waveguide segment, an electromagnet
30 secured to the outer wall of said waveguide segment, and a coil for creating a magnetic field
in said ferrite element.
5. A particle accelerator system, comprising:
 - a power source operable to generate radio frequency power;

an injector for producing pulses of electrons;

a first accelerating section connected to said injector for receiving said pulses of electrons, said first accelerating section being operable to receive said radio frequency waves from said power source via a first power delivery path and to transfer energy from said radio frequency power to said pulses of electrons; and,

a second accelerating section connected to said first accelerating section for receiving said pulses of electrons therefrom, said second accelerating section being operable to receive said radio frequency power from said power source via a second power delivery path;

wherein the amount of said radio frequency power delivered to said first accelerating section via said first power delivery path relative to the amount of said radio frequency power delivered to said second accelerating section via said second power delivery path alternates between successive said pulses of electrons to produce successive said pulses of electrons having alternating energy levels.

6. The particle accelerator system of Claim 5, wherein said second power delivery path includes a phase shifter interposed between said power source and said second accelerating section for receiving said radio frequency waves, for alternatively changing the phase of said radio frequency waves between successive pulses of said pulses of charged particles, and for delivering said radio frequency waves to said second accelerating section